CALIFORNIA AIR RESOURCES BOARD

Research Screening Committee Meeting
Cal/EPA Headquarters Building
1001 I Street
Conference Room 510, 5th Floor
Sacramento, California 95814
(916) 445-0753

January 31, 2020
9:00 a.m.

ADVANCE AGENDA

I. Approval of Minutes of Previous Meeting:

October 18, 2019

II. Discussion of a Request for Proposals (RFP):

1. "Remote Sensing Measurements of Light-Duty Vehicle Emissions at Multiple California Locations" $600,000

   The objective of this project is to use roadside-deployed remote sensing devices to measure exhaust carbon monoxide, hydrocarbons, and nitrogen oxides emission rates from light-duty vehicles and heavy-duty vehicles with downdraft exhaust tailpipes at eight California locations. The data will be useful to evaluate vehicle emission disparities between socioeconomically disadvantaged and non-disadvantaged communities across the State, continue tracking long-term fleet emission trends, evaluate United States-Mexico border-crossing vehicles' air pollution impact on border communities, gauge electric vehicle penetration in disadvantaged communities, and evaluate Smog Check program attributes including fraud quantification, change-of-ownership program areas, un-registered/out-of-state vehicles, biennial testing cycle (time since last inspection), and model year exemptions.

III. Discussion of Research Proposals

1. "Measurements of VOCs in the SoCAB: Chemical Characterization and Impacts on Potential Ozone and PM Formation," National Oceanic and Atmospheric Administration, $300,000, Proposal No. 2832-294

   Volatile organic compounds (VOCs) are precursors for the formation of both secondary organic aerosols (SOAs) and ozone (O3), which cause adverse health effects, especially among sensitive populations. These secondary pollutants of VOCs contribute to the poor air quality in regions of California that fall short of meeting the National Ambient Air Quality Standards (NAAQS). Recent work indicates that non-mobile sources of VOCs are becoming more important as mobile source emissions are reduced. More specifically, volatile chemical products (VCPs), which includes personal care products, cleaning agents, coatings, and adhesives, may comprise a large portion of the VOC emission inventory in the South Coast Air Basin (SoCAB). This project addresses the gap in understanding contemporary VOC composition by measuring a full suite of VOC species for five weeks in the summer of 2020 in Pasadena, California. Analysis of these measurements

will be used to evaluate all major VOC sources, including VCPs, and the relative contributions of VOCs to potential photochemical O3 and PM2.5 formation. This scientific characterization and assessment is needed for the development of the most effective air pollution control strategy for all regions of California to reach NAAQS, and for the future development of effective State Implementation Plan (SIP).

2. "Airborne Flux Measurement of Volatile Organic Compounds and Oxides of Nitrogen in California," University of California, Berkeley, $700,000, Proposal No. 2833-294

   Stringent emission controls have resulted in decreased ambient levels of O3 and PM2.5 known to cause adverse health effects, especially among sensitive populations. However, ambient O_3 and PM2.5 levels continue to frequently exceed the NAAQS in many regions of California. VOCs are the precursors for O3 and SOA. While VOC emissions from vehicles have decreased significantly, emissions from stationary sources (industrial, residential, biogenic) have not decreased as rapidly. There are additional concerns that global temperature rise may enhance the evaporative loss of VOCs and their reaction rates by an unknown amount. Therefore improving emission inventories of VOCs is essential to make accurate predictions of O3 and PM2.5 levels for future mitigation strategies. This project will carry out 40-hour airborne measurements using the Naval Postgraduate School Twin Otter aircraft in California's SoCAB in the summer of 2021. Fluxes of VOC and NOX will be measured using an airborne Vocus Proton Transfer Reaction Time-of Flight Mass Spectrometer and a Laser Induced Florescence NOX instrument, respectively, to create a database of measured emissions with approximately two kilometer spatial resolution. The measured VOC and NOX fluxes will be directly compared with emission inventories developed by CARB. The result of this project will help improve CARB's VOC and NOX emission inventories and the performance of a chemical transport model used to develop the SIPs. Such effort will identify viable pathways to optimize O3 and PM2.5 reductions in California.

3. "Low-Carbon Transportation Incentive Strategies using Performance Evaluation Tools for Heavy-Duty Trucks and Off-Road Equipment," University of California, Irvine, $1,000,000, Proposal No. 2834-294

   California needs to reduce greenhouse gas emissions and criteria pollutants from on-road heavy-duty vehicles (HDV) and off-road equipment (ORE) in order to meet its air quality and climate goals. Currently the CARB funds incentive programs to deploy low-carbon transportation (LCT) technology vehicles and powertrains to meet the operating requirements of heavy-duty and off-road vehicles. However, the benefit to the overall market, and the long-term health and economic impacts from these incentive programs is harder to quantify. Additionally, new strategies need to be designed to further incentivize the uptake of LCT that address remaining barriers to adoption and which target previously unexplored sectors. The objective of this project is to identify potential policy and incentive strategies that promote greater adoption of LCT (zero and near-zero carbon and pollutant emissions) in the heavy-duty and off-road sectors. This project will create an incentive program performance evaluation tool to quantify benefits of CARB incentive programs and design new strategies to increase the uptake of LCT technologies. The contractor will: 1) synthesize current incentive programs

and analyze their effect on LCT uptake among HDV and ORE; 2) develop an incentive program performance evaluation tool that quantifies the emissions reductions, health and ancillary benefits and cost-effectiveness of LCT incentive programs; 3) recommend incentive strategies by vehicle and vocation types, and at varying geographic scales (State, regional and community level); and 4) forecast LCT technologies' attainment of cost parity or market acceptance relative to conventional technologies without incentive program supports. The results will guide future incentive and regulatory programs to meet air quality and climate goals.

IV. Discussion of Draft Final Reports:

1. "Evaluation of the Feasibility, Cost-Effectiveness, and Necessity of Equipping Small Off-Road Diesel Engines with Advanced PM and/or NO_X Aftertreatment," University of California, Riverside, $800,000, Contract No. 14-300

   Current (Tier 4) emission standards for off-road engines generally do not require aftertreatment to reduce PM emissions for engines smaller than 25 hp, or NOX aftertreatment for engines smaller than 75 hp. These engines comprise an increasing share of the statewide inventories of these pollutants, however, and represent a potential future path for further reductions of these emissions. The objective of this contract was to evaluate the potential effectiveness, feasibility, and cost-effectiveness of implementing regulations on mobile off-road diesel engines with rated powers of less than 50 hp that will require the use of advanced emission control strategies, such as diesel particulate filters (DPFs) and selective catalytic reduction (SCR). A DPF was installed on a 20-hp transportation refrigeration unit (TRU) and a 25-hp excavator; both reduced PM emissions by over 97 percent both before and after a 1000-hr field demonstration. A SCR and a selective continuously regenerating technology (SCRT) system were installed on a 37-hp ride mower and a 49-hp skid steer, respectively; these reduced NOx by 50 to 80 percent depending on the duty cycle, which most likely impacted SCR temperature and the dosing of diesel exhaust fluid in the SCR and SCRT. These results demonstrate that the addition of advanced aftertreatment to off road engines smaller than 75 hp could reduce statewide off-road PM and NOX emissions by 0.2 and 15 – 23 tons per day, respectively. This represents two percent and 11 - 16 percent, respectively, of the total off-road emissions of these pollutants, and 0.2 percent and 1.4 – 2.2 percent of their total mobile source emissions. Furthermore, approximately 29 and 22 percent of statewide NOx from off-road diesel engines is emitted in the San Joaquin Valley (SJV) and SoCAB, respectively, where reductions are needed to meet NAAQS from PM and O3. The estimated total cost of these reductions is $29,000 / ton for PM reduction and $733 – $1039 / ton for NOx reduction. This price range for NOx is lower than approximately 70 to 80 percent of estimates from previous CARB NOx rulemaking efforts.

2. "Spatial Variation of Vertical Ozone Distribution over California," National Aeronautics and Space Administration, $65,549, Contract No. 17RD004

   California must further reduce ambient O3 levels to attain the 70 parts-per-billion (ppb) O3 NAAQS in regions like the SJV. Recent studies suggested

that baseline O3 coming into California may be increasing as a result of growing global air pollution emissions (i.e., from across the Pacific), and downward mixing of such air mass into the SJV may lead to O3 NAAQS exceedances. To better understand the influences of baseline O3 on the SJV's air quality, multiple research groups collaborated and conducted the California Baseline Ozone Transport Study (CABOTS) in 2016. Through a research partnership, the National Aeronautics and Space Administration (NASA) Alpha Jet Atmospheric eXperiment (AJAX) group conducted eight flights designed to investigate the incoming air, the variability of free-tropospheric O3, and the atmospheric transport of O3 across the State during the CABOTS field campaign. AJAX flights linked ozonesonde launches at the coast to lidar measurements in Visalia, California. This project will finalize and complete the analysis of the data collected by the NASA AJAX group during CABOTS, which will provide additional insight into baseline O3 transport mechanisms from the Pacific and into the SJV. The results will help CARB determine if and how atmospheric O3 transport impacts ground-level O3, especially on days when the ground-level O3 exceed the NAAQS in the SJV. The information can also help evaluate and improve the representation of the horizontal transport and downward mixing processes of O3 aloft in the regional air quality and meteorological models needed for the development of the SIPs.

3. "Women's Cardiovascular Risk from PM Exposure," University of California, Irvine, $629,977, Contract No. 16RD005

   Epidemiological studies have demonstrated that postmenopausal women are more susceptible than men to PM-induced cardiovascular (CV) disease. However, there is currently a lack of mechanistic and toxicity research to explain why. This present study aimed to look at whether impairment of ovarian function may be a mechanistic link between PM exposure and the more detrimental CV outcomes seen in postmenopausal women. In this project, mice exposed for three months to concentrated ambient particles (CAPs) were used to conduct three experiments to: 1) compare the cardiovascular responses between male and female mice, as well as any impacts on the ovaries; 2) analyze the impact of "surgical menopause" (through removal of the ovaries, or ovariectomy) on female responses; and 3) look at whether estrogen replacement would protect against any adverse health outcomes in the ovariectomized females. The study demonstrated that PM exposure can affect ovarian function, which may increase the risk for cardiovascular disease in women. The results of this work suggests that postmenopausal women should be considered for evaluation as a sensitive population in future reviews of the U.S. EPA's NAAQS for PM.

V. Other Business:

1. Update on Research Planning